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ABSTRACT

The course outline has been prepared as a guide to assist the instructor to plan systematically and to present meaningful lessons to provide the training needed by the machine shop student. This is the third course of instruction in a series of machine shop work courses. The six blocks of instruction contained in this outline are designed to enable the student to obtain the manipulative skills and related knowledge necessary to understand and use correctly the metalworking lathe and its accessories in a safe and productive manner. The student must complete the second course, "Bench Work and Support Occupations," before entering this course, which consists of 135 clock hours. A posttest and bibliography are appended. Specific objectives are provided for each instructional block. (Author/AJ)

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AUTHORIZED COURSE OF INSTRUCTION FOR THE QUINMESTER PROGRAM

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Course Outline
MACHINE SHOP WORK - INTERMEDIATE - 9555
(Metalworking Lathe)
Department 48 - Quin 9555.03

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DADE COUNTY PUBLIC SCHOOLS
DIVISION OF INSTRUCTION • 1973

ED 096490

D A D E C O U N T Y P U B L I C S C H O O L S

1 4 5 0 N O R T H E A S T S E C O N D A V E N U E

M I A M I, F L O R I D A 33132

Course Outline

MACHINE SHOP WORK - INTERMEDIATE - 9555
(Metalworking Lathe)

Department 48 - Quin 9555.03

county office of

VOCATIONAL AND ADULT EDUCATION

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Dr. E. L. Whigham, Superintendent of Schools
Dade County Public Schools
Miami, Florida 33132

December, 1972

Published by the School Board of Dade County

Course Description

9555	48	9555.03	Metalworking Lathe
State Category Number	County Dept. Number	County Course Number	Course Title

This quinmester course provides the understanding of the metalworking lathe and its operation. The student will develop a knowledge of machine shop theory and practice as he studies and performs the basic operations on the lathe, including straight turning, taper turning, shoulder facing, threading, knurling, and cutting off stock. This is the third quinmester course taken in the first year of the vocational machine shop.

Indicators of Success: Prior to entry into this course, the student must display mastery of the skills indicated in Bench Work and Support Operations (9555.02)

Clock Hours: 135

PREFACE

The following course outline has been prepared as a guide to assist the instructor to plan systematically, and to present meaningful lessons programmed to meet the necessary training needed by the machine shop student.

This is the third course of instruction in machine shop work. The six blocks of instruction contained in this outline are designed to enable the student to obtain the manipulative skills and related knowledge necessary to understand and use correctly the metalworking lathe and its accessories in a safe and productive manner.

The student must complete the second quinmester course, "Bench Work and Support Operations," before entering into this third quinmester course, which consists of 135 clock hours.

The methods of instruction vary, depending upon the individual ability of the student. When presenting the subject matter, an instructor uses demonstrations, lectures, and question-answer techniques. The learning process is further promoted by the use of models, cutaways, diagrams, audio-visual aids, assignment sheets, unit of instruction plans, job sheets, and other types of instructional aids.

This outline was developed through the cooperative efforts of the instructional and supervisory personnel, the Quinmester Advisory Committee, and the Vocational Curriculum Materials Service, and has been approved by the Dade County Vocational Curriculum Committee.

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with Suggested Hourly Breakdown

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Work Hazards	2
Care and Maintenance	2
IV. MACHINING OPERATIONS (70 Hours)	
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GOALS

The student must be able to demonstrate:

1. Knowledge of the various types of metalworking lathes, their basic parts and accessories.

2. Knowledge and the ability to use the cutting tools and their holders in conjuction with the machining operation performed on the lathe.

3. Proficiency in performing the machining operations the lathe is designed to accommodate in a safe and productive manner.

4. Ability to select and calculate the speeds and feeds needed to efficiently perform metal removing operation on the lathe.

SPECIFIC BLOCK OBJECTIVES

BLOCK I - INTRODUCTION TO THE LATHE

The student must be able to:

1. List and define the types of metal working lathes utilized in metal work.
2. List and define the parts and their functions of the metal working lathe and the holding devices and accessories used in conjunction with them.

BLOCK II - CUTTING TOOLS AND HOLDERS

The student must be able to:

1. Exhibit the ability to grind and utilize the tool bits designed for the metal removing operations on the lathe by producing and using the tools to machine assigned work projects.
2. Demonstrate an understanding of and exhibit the ability to select and use the tool holding devices designed to support lathe cutting tools by utilizing them correctly to machine assigned projects.

BLOCK III - SAFETY AND MAINTENANCE PROCEDURES

The student must be able to:

1. Demonstrate an understanding of personal safety habits and work hazards by completing worksheets, oral discussions, and exhibiting safe work habits in the shop.
2. Demonstrate an understanding of the need for proper care and maintenance of the lathe and its accessories by completing worksheets or by oral discussions.
3. Exhibit the ability to properly care for and maintain the lathe and its accessories by using the correct methods when operating the equipment.

BLOCK IV - MACHINING OPERATIONS

The student must be able to:

1. Define and demonstrate the ability to use the various turning and hole machining operations the lathe is capable of performing by completing worksheets and utilizing them in assigned projects.
2. Define and demonstrate the ability to use the various set-up procedures by utilizing them on assigned projects and completing worksheets.

BLOCK V - SELECTING SPEEDS AND FEEDS

The student must be able to:

1. Exhibit the ability to select and calculate from the proper formulas the feed and speed of lathe workpieces.
2. Exhibit the ability to select and use the charts and handbooks that list the information needed to calculate or perform lathe machining operations by completing worksheets and test.

BLOCK VI - QUINMESTER POST-TEST

The student must be able to:

1. Satisfactorily complete the quinmester post-test.

Course Outline

MACHINE SHOP WORK - INTERMEDIATE - 9555
(Metalworking Lathe)

Department 48 - Quin 9555.03

I. INTRODUCTION TO THE LATHE

A. Types of Lathes
1. Bench
2. Floor
3. Turret
a. Vertical
b. Horizontal

B. Lathe Parts and Functions
1. Headstock
2. Tailstock
3. Carriage
4. Driving mechanism
5. Bed
6. Operating controls:
a. Feed reverse
b. Clutch
c. Feed change
d. Half-nut
e. Start-stop

C. Holding Devices
1. Chucks
a. Three jaw universal
b. Four jaw independent
2. Faceplate
3. Driving plate
4. Collets
5. Centers and dogs

D. Accessories
1. Taper attachment
2. Center rest
3. Steady rest
4. Follower rest

II. CUTTING TOOLS AND HOLDERS

A. Tool Bit Grinding
1. Rake and clearance angles
2. Nose radius
3. Stoning

B. Types of Tool Bits
1. Turning

a. Right hand
b. Left hand
c. Ruffing
d. Finishing

2. Facing
3. Cutoff
4. Threading
5. Forming
6. Boring

C. Tool Holders
1. Straight, right and left hand
a. Turning and facing
b. Boring
c. Cutoff
2. Special
a. Knurling
b. Threading
c. Carbide-tipped tool holder
d. Turret

III. SAFETY AND MAINTENANCE PROCEDURES

A. Personal Safety
1. Eye protection
2. Proper clothing
3. Jewelry removal
4. Proper shop conduct

B. Work Hazards
1. Mechanical
2. Materials
3. Holding devices
4. Floor area
5. Cutting tools
6. Hot, sharp chips

C. Care and Maintenance
1. Chip removal
2. Proper lubrication
3. Cleaning methods

IV. MACHINING OPERATIONS

A. Turning
1. Facing
2. Cutoff and recessing
3. Straight
4. Threading
5. Grooving and undercutting
6. Fillets and radii
7. Chamfering

IV. MACHINING OPERATIONS

8. Taper
9. Angle

B. Hole Machining
1. Drilling
2. Reaming
3. Boring and counterboring
4. Internal threading

C. Specialized Operations
1. Knurling
2. Filing and polishing
3. Lapping
4. Grinding

D. Set-Up Operations
1. Universal chuck
2. Independent chuck
   a. Use of indicator
   b. Tail stock support
3. Faceplate
   a. Clamping methods
   b. Counterbalance
4. Steady rest
5. Center rest
6. Follower rest

V. SELECTING SPEEDS AND FEEDS

A. Formulas
1. Cutting
   a. Speed
   b. Feed
2. Taper turning
   a. Taper attachment
   b. Tailstock offset
3. Threading
   a. Internal
   b. External

B. Charts and Handbooks
1. Threading
2. Speed and feed
3. Material
4. Finish desired

VI. QUINMESTER POST-TEST

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2. Cutting Threads with Taps and Dies. 16 mm. 19 min. B/W. Sound. United World Films, Inc.

3. Fundamentals of Filing. 16 mm. 12 min. B/W. Sound. United World Films, Inc.

4. Grinding Cutter Bits. 16 mm. 20 min. Color. Sound. South Bend Lathe Works.

5. Grinding a Parallel Bar. Part I. 16 mm. 14 min. B/W. United World Films, Inc.

6. Hacksaws. 16 mm. 18 min. B/W. Sound. United World Films, Inc.

7. Hammers. 16 mm. 11 min. B/W. Sound. United World Films, Inc.

8. Hand Soldering. 16 mm. 17 min. B/W. Sound. United World Films, Inc.

9. Hardness Testing: Rockwell. 16 mm. 18 min. B/W. Sound. United World Films, Inc.

10. Inspection of Threads. 16 mm. 22 min. B/W. Sound. United World Films, Inc.

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12. Micrometer. 16 mm. 15 min. B/W. Sound. United World Films, Inc.

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24. Verniers. 16 mm. 19 min. B/W. Sound. United World Films, Inc.

25. Wrenches. 16 mm. 20 min. B/W. Sound. United World Films, Inc.

A P P E N D I X

Quinmester Post-Test Sample

Quinmester Post Test

Name _____ Date _____ Score ____

Multiple Choice Test Items

Each statements needs a word, a figure, or a phrase to make it correct. Only one of the choices listed is correct. Place the letter of the choice you make in the space provided at the left edge of the sheet.

____ 1. When the tool travels along the work parallel to the lathe bed, it is referred to as what kind of feed:

a. Cross
b. Longitudinal
c. Radial
d. Circular

____ 2. The feeding and threading mechanism on a lathe includes three basic components; the end gear train, the quick change gear box, and the:

a. Step cone pulley
b. Bull gear and lock pin
c. Carriage and apron assembly
d. Back gear and reversing lever

____ 3. The part of the carriage assembly that may be set at any angle is called the:

a. Tool post
b. Cross slide
c. Compound rest
d. Shaftnut lever

____ 4. Cutting speed, surface feet per minute refers to:

a. Rpm's of the headstock spindle
b. Cross tool movement into the work
c. Stock the tool removes from the work
d. Linear tool movement along the work

____ 5. What type of standard toolholder permits machining close to the lathe chuck or faceplate:

a. Left-hand
b. Right-hand
c. Straight
d. Cutoff

____ 6. High-speed steel tool bits require a standard toolholder with a back rake angle of:

a. 0^{o}
b. 12^{o}
c. $16\frac{1}{2}^{o}$
d. 21^{o}

____ 7. A shape imparted to the face of a tool bit which produces a short, coiled chips is called a chip:

a. Coiler
b. Breaker
c. Pointer
d. Cutoff

____ 8. The recommended nose radius for a general purpose turning tool designed for moderate to light turning is:

a. 1/64"
b. 1/32"
c. 3/64"
d. 1/16"

____ 9. Regardless of tool bit type, a most important factor in setup of tool bit and holder in the toolpost is:

a. Flexibility
b. Straightness
c. Angle
d. Rigidity

____10. When mounting work between centers, the tailstock handwheel is adjusted until:

a. Firmly locked
b. A slight resistance is felt
c. Lathe rattles when under power
d. Not critical

____11. Before precision turning a workpiece, it is necessary to:

a. Obtain cutting oil
b. Check center alignment
c. Check handwheel location
d. Check stock length

____12. To turn a workpiece from the tailstock toward the headstock, the usual procedure generally requires what kind of tool bit:

a. Left-hand
b. Right-hand
c. Cutoff
d. Either type

____13. The rounded surface at the bottom of a shoulder cut is called:

a. A fillet
b. A corner
c. An edge
d. A round-off

____14. A follower rest would not be used in which of the following operations:

a. External threading
b. Shoulder turning
c. Turning a groove
d. Boring

____15. Principally knurling is what kind of operation:

a. Cutting
b. Forming
c. Turning
d. Boring

____16. On a diamond knurl, deep lines in one direction usually indicate a problem with tool:

a. Speed
b. Feed
c. Centering
d. Quality

____17. On lathe work, a back-geared speed is used for knurling while employing a longitudinal feed of approximately:

a. .001"-.010"
b. .020"-.030"
c. .040"-.050"
d. .060"-.070"

____18. Universal chucks in good condition will hold work accurately to within:

a. .0002" or .0003"
b. .020" or .030"
c. .002" or .003"
d. .040" or .050"

____19. The commonly used chuck which permits the most rapid centering of cylindrical stock is the:

a. Universal type
b. Spindle type
c. Independent type
d. Step and closure type

____20. When drilling and reaming with taper shank tools on the lathe, the tool is generally mounted in the:

a. Headstock spindle
b. Tailstock spindle
c. Tool post
d. Drill chuck

____21. In lathe work, the first step for accurate drilling or reaming is to:

a. Mount the workpiece
b. Check tool sharpness
c. Check center alignment
d. Mount the chuck

____22. The boring of small holes usually requires the use of what kind of boring tool:

a. Inserted tool bit boring bar
b. Forged boring bar
c. Small drill
d. Counterbore

____23. What is the name of the operation which produces an accurately turned and sized hole:

a. Drilling
b. Counterboring
c. Broaching
d. Boring

____24. To transfer accurate measurements from a 3/4" bored hole, one would employ what kind of tool:

a. Telescoping gage
b. Inside caliper
c. Inside micrometer
d. Small hole gage

____25. To turn a surface accurately parallel to a hole, one would use a device called a:

a. Centering bar
b. Boring bar
c. Mandrel
d. Bushing

____26. Tailstock setover may be calculated in three ways depending on what two factors with reference to the tapered surface:

a. Diameter and location
b. Diameter and length
c. Length and location
d. Length and lathe size.

____27. If the situation calls for a short, steep taper to be turned, what is the quickest and best method to employ:

a. Tailstock setover
b. Compound rest
c. Longitudinal feed
d. Taper attachment

____28. If the situation requires that varying lengths of workpieces be turned with a taper of ½" per foot, what is the best method to use:

a. Tailstock setover
b. Compound rest
c. Longitudinal feed
d. Taper attachment

____29. When turning a right-hand screw thread, the compound rest is normally set at:

a. 29^{o}
b. 30^{o}
c. 59^{o}
d. 60^{o}

____30. It is quite essential in terms of quality and efficiency to use a cutting lubricant when turning threads on:

a. Aluminum
b. Brass
c. Steel
d. Cast iron

____31. The turning of a 5/8 - 11 UNC 2A thread requires that the halfnut be engaged when the thread chasing dial revolves to:

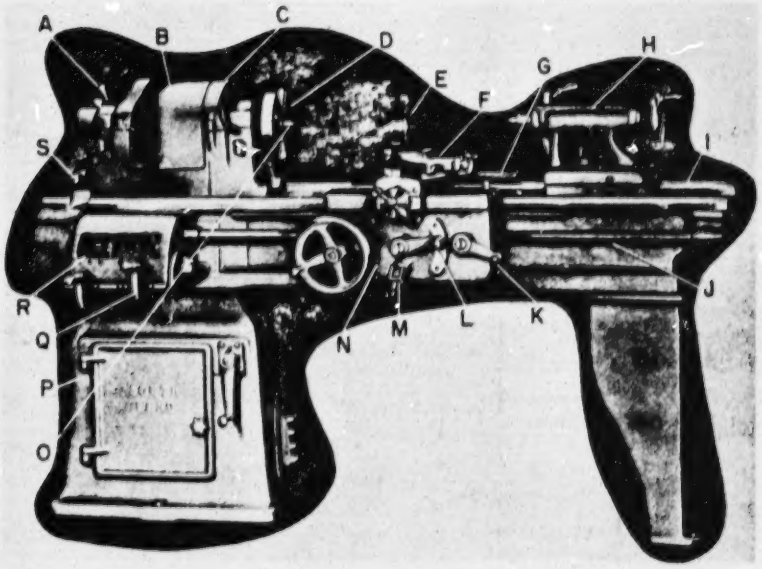
a. Any numbered line
b. Any even numbered line
c. Any odd numbered line
d. Any line

Matching Test Items

Set up the correct sequencial steps for turning an external thread on the lathe. Match the operations to the ordered sequence of steps by placing the letter preceding the operation in the brackets at the right of the steps.

A.	Finish the open end of the threaded section by chamfering.	1st	( )
		2nd	( )
B.	Return carriage to the starting point, and advance compound rest screw approximately .002".	3rd	( )
		4th	( )
C.	Set threading tool on center	5th	( )
D.	Withdraw threading tool at the end of cut by turning cross-feed screw one turn to the left and disengaging halfnut.	6th	( )
		7th	( )
		8th	( )
E.	Set micrometer collar on cross-feed screw to zero.	9th	( )
F.	Adjust gear train for desired ration.	10th	( )
G.	Test the height at which the point of the tool is set.	11th	( )
H.	Mount threading tool in tool holder for maximum rigidity.	12th	( )
		13th	( )
I.	Repeat steps 12-16 until desired depth of thread is reached.	14th	( )
		15th	( )
J.	Advance the threading tool until the point touches the work.	16th	( )
		17th	( )
K.	Set compound rest to 29°.	18th	( )
L.	Draw tool back past the right end of work, and advance compound rest screw approximately .002".	19th	( )
M.	Determine number of threads per inch.		
N.	Turn cross-feed screw one turn to the right or zero setting, and engage the halfnut at the appropriate point.		
O.	Select correctly ground tool bit.		
P.	Start the lathe and engage the halfnut when the appropriate number and/or line is even with line on the rim of the indicator.		
Q.	Mount work securely.		
R.	Remove workpiece, replace tools, and clean up work area.		
S.	With center gage set, tool square to the workpiece.		

Matching Test Items



Note the lettered parts of the lathe in the figure above. Match the parts to their proper names by placing the letter in the space provided next to the proper name.

____ 1. Motor drive unit

____ 2. Quick-change gear box

____ 3. Feed reverse lever

____ 4. Apron

____ 5. Clutch knob

____ 6. Halfnut lever

____ 7. Lead screw

____ 8. Bed ways

____ 9. Tailstock

____10. Faceplate

____11. Headstock

____12. Cone pulley cover

____13. Compound rest

____14. Back gear lever

____15. Tumbler lever

____16. Saddle

____17. Tool post

____18. Feed change lever

____19. Live center

____20. Leg

ANSWER KEY TO QUINMESTER POST-TEST

Multiple-Choice Test Items

1. b	12. b	23. d
2. c	13. a	24. a
3. c	14. d	25. c
4. a	15. a	26. b
5. b	16. b	27. b
6. c	17. b	28. d
7. b	18. c	29. a
8. b	19. a	30. c
9. d	20. b	31. a
10. b	21. c	
11. b	22. b	

Matching Test Items

1. M	8. S	15. B
2. F	9. G	16. N
3. Q	10. J	17. I
4. K	11. E	18. A
5. O	12. L	19. R
6. H	13. P	
7. C	14. D	

Matching Test Items

1. P
2. R
3. S
4. N
5. M
6. K
7. J
8. I
9. H
10. D
11. C
12. B
13. F
14. A
15. Q
16. G
17. E
18. L
19. O
20. T